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## 17.1 INTRODUCTION

This chapter of the Intel Packaging Databook addresses frequently asked questions (FAQ) regarding the material content of Intel products. In particular, the following are addressed: 1) Banned and restricted materials, 2) Lead and Halogen-free products; and 3) Material content of Intel products by package type and form factor.

## 17.2 MATERIAL COMPOSITION OF INTEL PRODUCTS

The material composition of electronic products has become an important piece of information throughout the supply chain as both component suppliers and OEM customers comply with regulations that restrict the material content of electronic products and require their collection and recycling at end of life.

As described in the [EIA/EICTA/JGPSSI Joint Industry Material Composition Guide](#), “the Electrical and Electronic Equipment (EEE) industry tracks and discloses the material composition of its products due to legal and market requirements. The industry needs to gather information about the composition of products and subparts that are purchased from suppliers for incorporation into final products. Material composition information allows manufacturers to: a) satisfy legal and regulatory requirements; b) drive improvements in product design; and c) respond to inquiries from customers, product recyclers and other stakeholders.

(Source: *Joint Industry Material Composition Guide*, page 3.)

### 17.3 BANNED AND RESTRICTED SUBSTANCES

Intel manufactures a wide range of products, from microprocessors, through embedded controllers, up to complete OEM systems. A large number of subassemblies and components are purchased from other manufacturers. Intel goes to great lengths to make sure all our products meet applicable legal requirements, and we continually monitor changes in those requirements. We have surveyed our products, and to the best of our knowledge, Intel is in compliance with all applicable national and international laws and regulations, including those that may restrict the materials content of certain products.

Intel is frequently asked by its customer base about the presence of certain materials in its products. Intel's [Environmental Product Content Specification for Suppliers and Outsourced Manufacturers](#) specifies those materials and substances which are restricted. Using currently accepted analytical methods and through active management of our supply chain, the following materials have not been shown to be present in Intel products within the detectable range:

**Table 5.1**  
**Materials listed in Annex A of the EIA/EICTA/JGPSSI Material Composition Declaration Guide**

Asbestos	Mercury/Mercury Compounds	Polychlorinated Naphthalenes
Azo colorants	Ozone Depleting Substances	Radioactive Substances
Cadmium /Cadmium Compounds	Polybrominated Biphenyls (PBBs)	Shortchain Chlorinated Paraffins
Hexavalent Chromium	Polybrominated Diphenylethers (PBDEs)	Tributyl Tin (TBT) and Triphenyl Tin (TPT)
Hexavalent Chromium Compounds	Polychlorinated Biphenyls (PCBs)	Tributyl Tin Oxide (TBTO)

#### 17.3.1 OZONE DEPLETING SUBSTANCES (ODS)

Intel Corporation eliminated the use of Class I ozone-depleting substances, as defined by U. S. law and the Montreal Protocol, in all manufacturing operations worldwide by September 1994. Any product manufactured by Intel does not contain and was not manufactured with these materials. In addition, our suppliers are screened, and to the best of our knowledge, no items supplied to Intel contain or are manufactured with Class I ozone depleting substances.

#### 17.3.2 HALOGENATED FLAME RETARDANTS

Intel restricts its supply chain from using PBB and PBDE compounds in all materials, parts, subassemblies and products supplied to Intel. For more information about materials restricted by Intel, please refer to: <http://supplier.intel.com/ehs/environmental.htm>.

The most common halogenated flame retardant used in Intel products is tetrabromobisphenol-A or TBBPA. Currently, no bans exist or have been proposed for TBBPA, including the Restriction of Hazardous Substances (RoHS) Directive from the European Union. Intel is also evaluating the use of halogenated flame retardants in its products and is working with suppliers and several industry consortia to drive the development of safe replacement materials.

### 17.3.3 LEAD (Pb)

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Directive 2002/95/EC (often referred to as the RoHS Directive) passed by the European Parliament prohibits new electrical and electronic equipment from containing lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers beginning in July 1, 2006. Lead/Pb-free products are defined as “electrical and electronic assemblies and components in which the lead (Pb) level in any of the raw materials comply with Pb-free requirements and/or legislation (i.e., RoHS Directive 2002/95/EC). Note that some uses of lead such as first level die-to-substrate interconnect are exempt. Such uses of lead will be documented in the Intel MDDS.

Intel is committed to finding appropriate, feasible, and cost-effective ways to reduce lead (Pb) in its products. To accomplish this mission, Intel is working proactively with other companies in the industry to establish standards and identify compatible technologies to support the migration away from tin-lead solder. Intel recently announced it plans related to lead/Pb-free technologies. Please refer to:

<http://www.intel.com/research/silicon/leadfree.htm>

#### 17.3.3.1 LEAD-FREE (Pb-FREE) MARKING

As new lead-free materials and products are created, labeling is required to ensure the proper manufacture, assembly, handling and recycling of these materials/products. In order to properly identify lead-free (Pb-free) and other reportable materials in lead/Pb-free assemblies, components and devices, JEDEC<sup>1</sup> and IPC<sup>2</sup> drafted a lead/Pb-free labeling standard titled “*JESD97: Marking, Symbols, and Labels for Identification of Lead (Pb) Free Assemblies, Components, and Devices (JESD97)*”<sup>3</sup>.

The purpose of JESD97 is “to provide a distinctive symbol and labeling format to identify those assemblies, components or devices that are totally Pb-free and/or are capable of providing or have Pb-free 2nd level interconnects. It also provides for identification of certain types of Pb-free materials and the maximum safe processing temperature during assembly or rework. It is meant to address only the Pb-free aspects RoHS compliance and does not address compliance to other banned materials. Table 17.2 (below) summarizes the JEDEC proposed symbols and their definitions.

Proposed Mark	Categorization and Material Type
e1	SnAgCu (any mixture) This is not included in category e2.
e2	Sn alloys with no Bismuth or Zinc (excludes SnAgCu); (i.e. SnCu, SnAg, SnAgCuX)
e3	Tin Plate (all forms)
e4	Precious Metals: Au, NiPd, NiPdAu (no Sn)
e5	Zinc containing: SnZn, SnZnX (no Bi)
e6	Contains any Bismuth
e7	Low Temperature solder (<150C) Contains Indium, but no Bismuth

<sup>1</sup> The JEDEC Solid State Technology Association (Once known as the Joint Electron Device Engineering Council), is the semiconductor engineering standardization body of the Electronic Industries Alliance (EIA), a trade association that represents all areas of the electronics industry. Source: [http://www.jedec.org/Home/about\\_jedec.cfm](http://www.jedec.org/Home/about_jedec.cfm)

<sup>2</sup> IPC changed its name from Institute of Interconnecting and Packaging Electronic Circuits to IPC. Source: <http://www.ipc.org/contentpage.asp?Pageid=2.1.1>

<sup>3</sup> Please refer to the current Catalog of JEDEC Engineering Standards and Publications online at <http://www.jedec.org/Catalog/catalog.cfm>

Below are examples of Intel products with the Pb-free marking.



## 17.4 MATERIALS THAT MAY BE CONTAINED IN INTEL PRODUCTS

The following list of materials is from the EIA/EICTA/JPSSI Joint Guide (Annex B Materials) and **may** be contained in Intel products. If they are present in concentrations above 1000 parts per million (ppm), they will be reported in the MDDS.

**Table 5.3**

**Materials listed in Annex B of the EIA/EICTA/JGPSSI Material Composition Declaration Guide**

Antimony/Antimony compounds
Arsenic/Arsenic compounds
Beryllium/Beryllium compounds
Bismuth/Bismuth compounds
Brominated Flame Retardants (other than PBB and PBDE)
Nickel/Nickel compounds
Vinyl Chloride Polymer (PVC)

## 17.5 INTEL MATERIAL DECLARATION DATA SHEETS (MDDS)

The Material Declaration Data Sheets (MDDS) contained in this chapter are based upon the format established by the Electronic Industries Alliance (EIA), The European Information and Communication Technology Association (EICTA) and the Japan Green Procurement Survey Standardization Initiative (JGPSSI). This format is published as the Joint Industry Guide for Material Composition Declaration and can be found at: <http://www.eia.org/resources/2003-09-19.10.pdf>

Most of the data sheets contained in this chapter are based on third-party analytical testing of the product specified in footnote #2 of each MDDS. If a product is not specified in footnote #2, the data listed in that MDDS are based on engineering estimates. Data sheets are organized by representative package types which cover the range of similar products. Since multiple products may be covered by a data sheet, data are reported in parts per million (ppm). Mass of the product is provided. Mass of individual materials can be calculated by the user as needed.

MDDSs for other package families will be added to this chapter as they become available. In addition, existing MDDSs will be updated periodically as additional data becomes available. Users of MDDS are responsible for consulting this chapter regularly to ensure they are using the most recent MDDS version.

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MDDSs are also available for the following board-level products. Please contact the appropriate Product Regulations Engineer (PRE) to request Data Sheets.

- Network interface cards (NICs)
- Wireless Cards
- Desktop motherboards
- Server motherboards